REMARKS

Claims 1-22 remain pending in the application. No amendments thereto are submitted herewith. Reconsideration of the application is respectfully requested in view of the following remarks.

The Office Action rejected the claims on two grounds. The first ground was lack of written description under 35 USC § 112, first paragraph. The second ground was anticipation under 35 USC § 102(e) by U.S. Patent 6,015,214 (Heenan et al.).

Written Description

In the Submission of Jan. 21, 2005, in response to an earlier Written Description rejection, the undersigned provided a detailed explanation of how the application teaches "rectangular cube corner elements" at least in connection with the cube corner elements of FIG. 9, where each cube corner element has a "left", "right", "top", and "bottom" boundary or border. In particular, the Submission explained how the specification teaches embodiments wherein:

(a) the left and right borders are parallel to each other;

(b) the top and bottom borders are parallel to each other; and

(c) the top and bottom borders are perpendicular to the left and right borders.

The Submission further stated "the top/bottom borders can have a dimension that is different than that of the left/right borders", and showed where the specification provides support for this additional feature in the recitation of "different ranges" for groove vertices compared to lamina thickness.

The most recent Office Action found the argument unconvincing because "the teaching of the different ranges given for the spacing of groove vertices 33 does not suggest the cube corner elements has [sic] a rectangular shape." We interpret this to mean that the Examiner is unconvinced that the specification teaches that the top/bottom borders have a different dimension than the left/right borders.

In hindsight, it was unnecessary for the Submission to discuss the *additional feature* (i.e., that the top/bottom borders have a different dimension than the left/right borders). Whether or not this *additional feature* exists is irrelevant to the essential requirements of a rectangle, which requirements are set forth in items (a)-(c) above, the support for which has not been challenged in the Office Action. The requirements of items (a)-(c), without more, are consistent with the following ordinary definitions for rectangle:

rectangle (n). A parallelogram with a right angle.

The American Heritage Dictionary, Second College Edition, Houghton Mifflin Co. (Boston, 1991), p. 1035.

rectangle or **oblong,** n. A parallelogram with four right angles. An equilateral rectangle is a SQUARE.

The HarperCollins Dictionary of Mathematics, E. J. Borowski and J. M. Borwein, (HarperResource, 1991), p. 494.

Hence, even assuming *arguendo* that the teaching of the "different ranges" in the specification fails to teach that the top/bottom borders have a different dimension than the left/right borders, the rejection of claims 1-21 under 35 USC § 112, first paragraph cannot be sustained because, as explained in the prior Submission, the specification plainly teaches items (a)-(c) at least in connection with the cube corner elements of FIG. 9, thus it plainly teaches "rectangular cube corner elements". Withdrawal of the rejection under 35 USC § 112, first paragraph is respectfully requested.

Anticipation

The Office Action also rejected claims 1-22 as anticipated (under 35 USC § 102(e)) by '214 Heenan et al. These claims, however, were copied either identically or substantially from the '214 Heenan et al. reference. Upon the resolution of the 35 USC § 112 first paragraph rejection discussed above, Applicant intends to submit an appropriate showing pursuant to 37 CFR § 41.202 so that an interference can be declared.

CONCLUSION

Applicant submits that the pending claims 1-22 conform to the written description requirement of 35 USC § 112, first paragraph, and that the rejection should be withdrawn.

If the Examiner should have any further questions or comments relating to the foregoing, which questions or comments could be readily resolved or discussed in an interview setting, he is respectfully requested to consider contacting the undersigned to arrange such an interview so that the prosecution of the present application can be timely advanced.

No fee is believed to be due by submission of this paper. If this belief is in error, please charge any required fee to Deposit Account No. 13-3723.

Respectfully submitted,

24 Oct 2005
Date

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3M Innovative Properties Company
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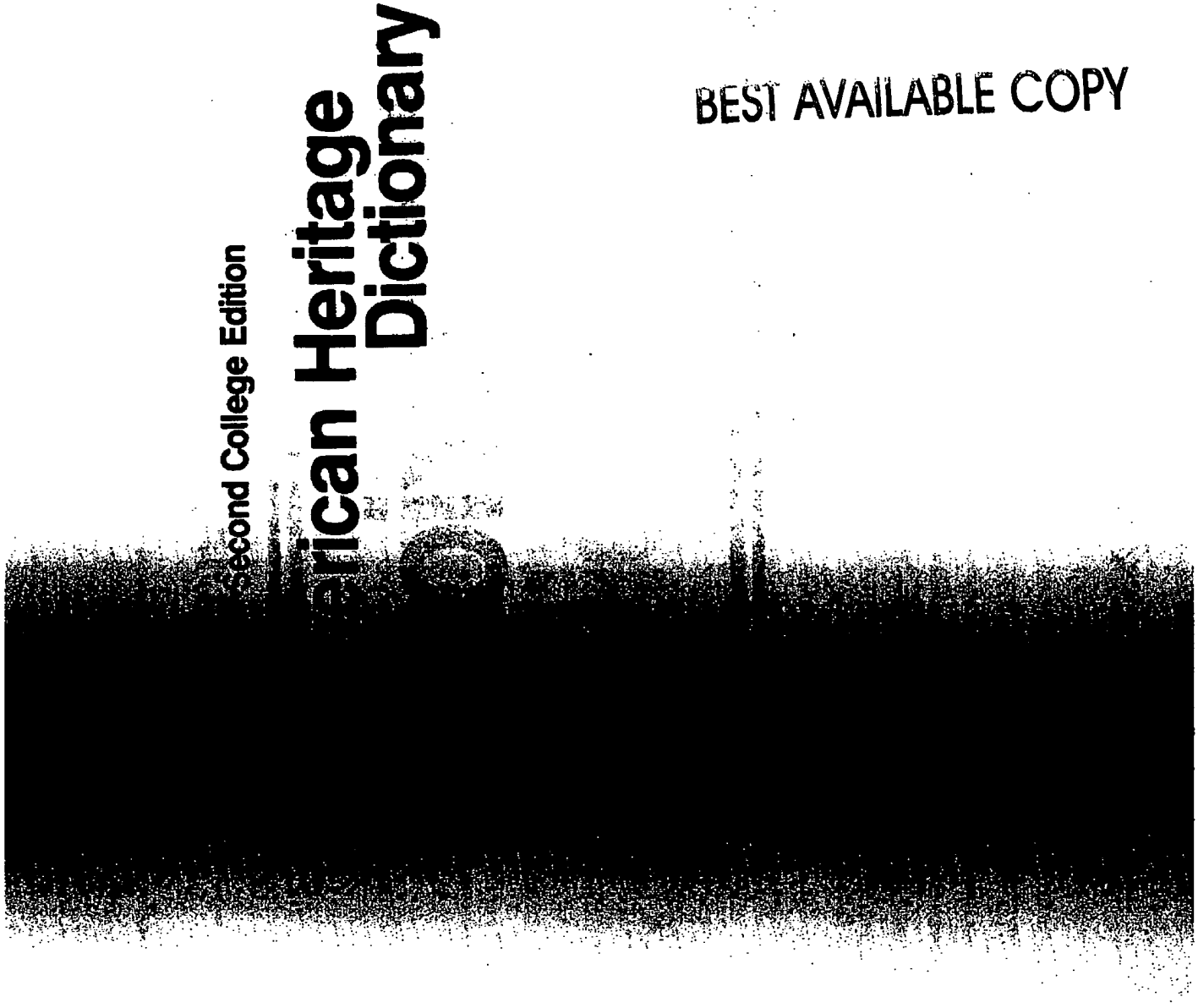
Attachment: copies of dictionary definitions of "rectangle"



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CONTENTS

dion. **reckon with.** To come to terms or settle accounts with. [ME *rekenen* < OE *gerecenian*, to explain.]

-on-er (rĕk'ə-nər) *n.* 1. One that reckons. 2. A handbook of mathematical tables to facilitate computation.

-on-ing (rĕk'ə-nĭng) *n.* 1. The act of counting. 2. An itemized bill or statement of a sum due. 3. A settlement of accounts: *a day of reckoning.* 4. **a.** The act or process of calculating the position of a ship or aircraft. **b.** The position calculated.

aim (rĭ-klām') *tr.v.* **-claimed, -claim·ing, -claims.** 1. To make suitable for cultivation or habitation, as by filling, draining, or fertilizing: *reclaim marshlands.* 2. To procure (usable substances) from refuse or waste products. 3. To reform from error, evil, or barbarism: reform. 4. To tame (an animal, for example). [ME *reclamen*, to call back < OFr. *reclamer*, to entreat < Lat. *reclamare* : *re-*, against + *clamare*, to call out.] —**re-claim'a-ble** *adj.* —**re-claim'ant, re-claim'er** *n.*

la-ma-tion (rĕk'lə-mā'shən) *n.* 1. The act or process of reclaiming. 2. A restoration, as to productivity, usefulness, or morality. [OFr. < Lat. *reclamatio*, cry of opposition < *reclamare*, to exclaim against. —see RECLAIM.]

lame (rĕ-klām') *n.* 1. Public acclaim. 2. A taste or flair for publicity. [Fr., advertising < *réclamer*, to claim < OFr. *reclamer*, to exclaim against. —see RECLAIM.]

li-nate (rĕk'lə-nāt') *adj. Bot.* Bent or turned downward at the base. [Lat. *reclinatus*, p.part. of *reclinare*, to recline.]

line (rĭ-klīn') *v.* **-clined, -clin·ing, -clines.** —*tr.* To cause to assume a leaning or prone position. —*intr.* To lie back or recline. [ME *reclinen* < OFr. *recliner* < Lat. *reclinare* : *re-*, back + *clinare*, to bend.] —**rec'li-na'tion** (rĕk'lə-nā'shən) *n.* **e-clin'er** *n.*

lu-sion (rĭ-klōō'zhən) *n.* 1. The condition of being a recluse. 2. The state of being in solitary confinement.

lu-sive (rĭ-klōō'sĭv, -zĭv) *adj.* 1. Seeking or preferring seclusion or isolation. 2. Providing seclusion: *a reclusive hut.*

og-ni-tion (rĕk'ag-nĭsh'ən) *n.* 1. The act of recognizing or condition of being recognized. 2. An awareness that nothing perceived has been perceived before. 3. An acknowledgment, as of a claim: *a recognition of their civil rights.* 4. Attention or favorable notice: *recognition for his many achievements.* 5. An acknowledgment or acceptance of the national status of a new government by another nation. [Lat. *recognitio* < *recognoscere*, to recognize.] —**re-cog'ni-to'ry** (rĭ-kŏg'nə-tôr'ē, -tōr'ē), **re-cog'ni-tive** *adj.*

og-ni-zance (rĭ-kŏg'nĭ-zəns, -kŏn'ĭ-) *n.* 1. *Law.* **a.** An obligation of record entered into before a court or magistrate with the condition to perform a particular act, as to appear in court. **b.** A sum of money pledged to assure the performance of such an act. 2. A recognition. 3. *Archaic.* A badge; token. [ME < OFr. *reconoissance* < *reconoistre*, to recognize.] —**re-cog'ni-zant** *adj.*

og-nize (rĕk'əg-nīz') *tr.v.* **-nized, -niz·ing, -niz·es.** 1. To know to be something that has been perceived before: *recognize a face.* 2. To know or identify from past experience or knowledge: *recognize hostility.* 3. To perceive or acknowledge the validity or reality of: *recognize a demand.* 4. To take knowledge as a speaker. 5. To acknowledge or accept the political status of as a new government. 6. To acknowledge, approve of, or appreciate: *recognize services rendered.* 7. To admit the acquaintance of, as by salutation: *recognize an old friend with a cheerful greeting.* 8. *Law.* To enter into a recognizance. [OFr. *reconoistre, reconniss-* < Lat. *recognoscere* : *re-*, again + *cognoscere*, to know.] —**rec'og-niz'a-ble** *adj.* **rec'og-niz'a-bly** *adv.* —**rec'og-niz'er** *n.*

oil (rĭ-koil') *intr.v.* **-coiled, -coil·ing, -coils.** 1. To kick or spring back, as upon firing. 2. To shrink back in fear or repugnance. 3. To fall back; return. —*n.* (*also* rē'koil'). The backward action or kick of a firearm upon firing. The act or state of recoiling; reaction. [ME *recoilen* < OFr. *reculer* : *re-*, back (< Lat.) + *cul*, buttocks < Lat. *culus*.] —**re-coil'er** *n.*

Synonyms: *recoil, blench, cower, quail, shrink, cringe, flinch. Recoil* implies instinctive, involuntary drawing back, as from something dangerous or repulsive. *Blench* applies to the act of shying back or turning away. *Cower, quail,* and *shrink* imply fear or despair, involving avoidance of that which is difficult by shying away, sinking downward, or huddling. *Cringe* suggests crouching or slinking resulting

collect again. 2. To calm or control (oneself).

rec-ol-lec-tion (rĕk'ə-lĕk'shən) *n.* 1. The act of recollecting. 2. Something recollected.

re-com-bi-nant (rē-kŏm'bə-nənt) *n.* An organism of genetic recombination has taken place. —*adj.*

recombinant DNA *n.* DNA prepared through manipulation in which genes from one species or organism are transplanted or spliced to another.

re-com-bi-na-tion (rē'kŏm-bə-nā'shən) *n.* The offspring of genetic combinations not present

rec-om-mend (rĕk'ə-mĕnd') *tr.v.* **-mend·ed, -mend·ing, -mends.** 1. To praise or commend to another as worthy or desirable; endorse: *recommended him highly.* 2. To make attractive or acceptable: *However, it does not recommend itself to any person.* 3. To commit to the charge of another; entrust. 4. To counsel or advise (that something be done). [ME *recommenden* < Med. Lat. *recommendare* : Lat. *re-* + Lat. *commendare*, to entrust (*com-*, together + *mandare*, to order).] —**rec'om-mend'a-ble** *adj.* —**rec'om-**

rec-om-men-da-tion (rĕk'ə-mĕn-dā'shən) *n.* 1. The act of recommending. 2. Something that recommends: *a favorable statement concerning the character or abilities of someone.* —**rec'om-men'da-to'ry** (-də-tôr'ē, -tōr'ē).

re-com-mit (rē'kə-mĭt') *tr.v.* **-mit·ted, -mit·ting, -mits.** To commit again. 2. To refer (proposed legislation, for example) to a committee again. —**re'com-mit'ment, re'com-mit'tal** (-mĭt'l) *n.*

rec-om-pense (rĕk'əm-pĕns') *tr.v.* **-pensed, -pens·ing, -pens·es.** 1. To award compensation to. 2. To make compensation for; make a return for. —*n.* 1. Amends for something, as damage or loss. 2. Payment for something given or done, as services. [ME *recompensen* < OFr. *recompenser* < LLat. *recompensare* : Lat. *re-* + Lat. *compensare*, to compensate. —see COMPENSATE.]

re-com-pose (rē'kəm-pōz') *tr.v.* **-posed, -pos·ing, -pos·es.** 1. To compose again: reorganize or rearrange. 2. To restore to composure; calm. —**re'com-po-si'tion** (rē'kŏm-pə-zĭsh'ən) *n.*

re-con (rē'kŏn') *n.* The smallest genetic unit capable of recombination. [RECOMBINATION] + -ON.

rec-on-cil-a-ble (rĕk'ən-sī'lə-bəl, rĕk'ən-sī'-) *adj.* Capable or qualified for reconciliation. —**rec'on-cil'a-bil'i-ty, rec'on-cil'a-ble-ness** *n.* —**rec'on-cil'a-bly** *adv.*

rec-on-cile (rĕk'ən-sīl') *tr.v.* **-ciled, -cil·ing, -ciles.** To establish friendship between. 2. To settle or resolve (a dispute. 3. To bring (oneself) to accept. 4. To render compatible or consistent: *reconcile my way of thinking with yours.* [ME *reconsilen* < OFr. *reconcilier* < Lat. *reconciliare*, to conciliate < *conciliare*, to conciliate.] —**rec'on-cile'ment, rec'on-cil'i-a'tion** (-sĭl'ē-ā'shən), **rec'on-cil'er** *n.* —**rec'on-cil'i-a-to'ry** (-sĭl'ē-ə-tôr'ē, -tōr'ē) *adj.*

rec-on-dite (rĕk'ən-dīt', rĭ-kŏn'dīt') *adj.* 1. Not understood; abstruse. 2. Concerned with or treating abstruse or obscure: *recondite scholarship.* 3. Secret; hidden. [Lat. *reconditus*, p.part. of *recondere*, to hide (*re-*, back + *condere*, to hide (*com-*, together) + *dare*, to give).] —**rec'on-dite'ly** *adv.* —**rec'on-dite'ness** *n.*

re-con-di-tion (rē'kən-dĭsh'ən) *tr.v.* **-tioned, -tion·ing, -tions.** To restore by repairing, renovating, or rebuilding.

re-con-firm (rē'kən-fûrm') *tr.v.* **-firmed, -firm·ing, -firms.** To confirm again, esp. to establish or support anew. —**re'con-fir-ma'tion** (rē'kŏn-fər-mā'shən) *n.*

re-con-nais-sance also **re-con-nois-sance** (rĭ-kŏn'ĭ-səns) *n.* An inspection or exploration of an area made to gather military information. [Fr. < OFr. *reconoissance* < *reconoistre*, to recognize < Lat. *recognoscere*, RECOGNIZE.]

re-con-noi-ter (rē'kə-noi'tər, rĕk'ə-) *v.* **-tered, -ter·ing, -ters.** —*tr.* To make a preliminary inspection of: —*intr.* To make a reconnaissance. [Obs. Fr. *reconnoitre* < OFr. *reconoistre*, to recognize. —see RECONNAISSANCE.] —**re'con-noi'ter-er** *n.*

re-con-sid-er (rē'kən-sĭd'ər) *v.* **-ered, -er·ing, -ers.** 1. To consider again, esp. with intent to alter a previous decision. 2. To take up for reconsideration, as a matter previously acted on by a legislature. —**re'con-sid'er-a'tion** *n.*

re-con-struct (rē'kən-strŭkt') *tr.v.* **-struct·ed, -struct·ing, -structs.** To construct again.

re-con-struc-tion (rē'kən-strŭk'shən) *n.* 1. The act of reconstructing. 2. **Reconstruction.** The period during which the states of the Southern Confederacy were controlled by the Federal government before being admitted to the Union. —**re'con-struc'tive** *adj.*

re-con-vert (rē'kən-vûrt') *v.* **-verted, -vert·ing, -verts.**

means for reproduction. —*intr.* To record something.

rec-ord (rĕk'ərd). 1. **a.** An account, as of information, facts, set down esp. in writing as a means of preserving knowledge. **b.** Something on which such an account is made. **c.** Something that records: *a fossil record.* 2. Information or data on a particular subject collected and preserved: *the coldest day on record.* 3. The known history of a person's or achievement: *your high-school record.* 4. The highest performance known, as in a sport: *the world record in the 5. Law.* **a.** An account officially written and preserved as evidence or testimony. **b.** An account of judicial or legislative proceedings written and preserved as evidence. **c.** The documents or volumes containing such accounts. 5. **a.** A disk designed to be played on a phonograph, bearing magnetic tape, on which sound or information have been recorded. —**idioms. off the record.** Not for publication: *told me that his remarks were strictly off the record.* **on record.** Known to have stated or taken a position: *wanted to go on record as opposing the new* [ME *recorden* < OFr. *recorder* < Lat. *recordari*, to remember : *re-*, again + *cor*, heart.]

rec-ord-er (rĭ-kôr'dər) *n.* 1. One that records, as a tape recorder. 2. A judge who has criminal jurisdiction in a city. 3. A flute with eight finger holes and a whistlelike mouthpiece.

rec-ord-ing (rĭ-kôr'dĭng) *n.* 1. Something on which sound or images have been recorded. 2. A recorded sound or performance.

re-count' (rē-kount') *tr.v.* **-count·ed, -count·ing, -counts.** To tell the facts or particulars of. 2. To enumerate. [ME < OFr. *recounter* : *re-*, again + *conter*, relate. See COUNT.] —**re-count'al** *n.*

re-count' (rē'kount') *tr.v.* **-count·ed, -count·ing, -counts.** To count again. —*n.* (*also* rē'kount'). An additional count, esp. a recount of votes cast in an election.

re-coup (rĭ-kōōp') *v.* **-couped, -coup·ing, -coups.** —*tr.* 1. To make equivalent for; make up for: *recoup a loss.* 2. To make equivalent for; reimburse. 3. *Law.* To deduct or withhold part of something due) for an equitable reason. —*intr.* To regain a former favorable position. —*n.* The act of recouping. [ME *recoupen* < OFr. *recouper*, to cut back : *re-* (< Lat.) + *couper*, to cut < *coup*, blow. —see COUP.] —**re-coup'a-ble** *adj.* —**re-coup'ment** *n.*

re-course' (rē'kôrs', -kōrs', rĭ-kôrs', -kōrs') *n.* 1. The act or possibility of turning or applying to a person or thing for aid or protection: *have recourse to the courts.* 2. One that is turned to for aid or security: *His only recourse was the police.* 3. *Law.* The right to demand payment from the endorser of commercial paper when the first party liable defaults. [ME *recours* < OFr. < Lat. *recursus*, a running back < *recurrere*, to run back : *re-*, back + *currere*, to run.]

re-cov'er (rĭ-kŭv'ər) *v.* **-ered, -er·ing, -ers.** —*tr.* 1. To get back; regain. 2. To restore (oneself) to a normal state. 3. To make up for. —*intr.* 1. To regain a normal or usual condition; get well. 2. To receive a favorable judgment in a lawsuit. [ME *recoveren* < OFr. *recoverer* < Lat. *recuperare*, RECUPERATE.] —**re-cov'er-a-ble** *adj.* —**re-cov'er-er** *n.*

re-cov-er-y (rĭ-kŭv'ə-rē) *n., pl.* **-ies.** 1. An act, instance, or duration of recovering. 2. A return to a normal condition. 3. Something gained or restored in recovering. 4. The act of obtaining usable substances from unusable material or waste material.

recovery room *n.* A hospital room equipped for the care and observation of patients immediately following surgery.

rec-re-ant (rĕk'rē-ənt) *adj.* 1. Unfaithful or disloyal to a belief or cause. 2. Craven or cowardly. —*n.* 1. A faithless or disloyal person. 2. A coward. [ME < OFr., pr.part. of *recroire*, to remember < Med. Lat. *recredere* : Lat. *re-*, back + *credere*, to entrust.] —**rec're-ance, rec're-an-cy** *n.* —**rec're-ant-ly** *adv.*

re-cre-ate (rĕk'rē-āt') *v.* **-at·ed, -at·ing, -ates.** —*tr.* To impart new life or refresh mentally or physically. —*intr.* To take recreation. [Lat. *recreare, recreat-* : *re-*, anew + *creare*, to create.] —**rec're-a'tive** *adj.*

re-cre-ate (rĕk'rē-āt') *tr.v.* **-at·ed, -at·ing, -ates.** To create again.

rec-re-a-tion (rĕk'rē-ā'shən) *n.* Refreshment of one's mind

—*tr.* To accuse in return. —*intr.* To counter one accusation with another. [Med. Lat. *recriminare, recriminat-* : Lat. *re-*, against + *criminare*, to accuse < *crimen*, accusation.] —**re-crim'i-na'tive, re-crim'i-na-to'ry** (-nə-tôr'ē, -tōr'ē) *adj.* —**re-crim'i-na'tor** *n.*

re-crim-i-na-tion (rĭ-krĭm'ə-nā'shən) *n.* 1. The act of recriminating. 2. A countercharge.

re-cru-desce (rē'krōō-dĕs') *intr.v.* **-desced, -desc·ing, -desces.** To break out anew after a dormant or inactive period. [Lat. *recrudescere*, to grow raw again : *re-*, again + *crudescere*, to get worse < *crudus*, raw.] —**re'cru-des'cence** *n.* —**re'cru-des'cent** *adj.*

re-cruit (rĭ-krōōt') *v.* **-cruit·ed, -cruit·ing, -cruits.** —*tr.* 1. To engage (persons) for military service. 2. To strengthen or raise (an armed force) by enlistment. 3. To supply with new members or employees. 4. To enroll or seek to enroll: *colleges recruiting minority students.* 5. To replenish. 6. To renew or restore the health, vitality, or intensity of. —*intr.* 1. To raise a military force. 2. To obtain replacements for or new supplies of something lost, wasted, or needed. 3. To regain lost health or strength; recover. —*n.* 1. A newly engaged member of a military force, esp. one of the lowest rank or grade. 2. A new member of an organization or body. [Fr. *recruter* < obs. *recrute*, recruit < OFr. *recroistre*, to grow again < Lat. *recrescere* : *re-*, again + *crescere*, to grow.] —**re-cruit'er** *n.* —**re-cruit'ment** *n.*

rec-ta (rĕk'tə) *n.* A plural of **rectum.**

rec-tal (rĕk'təl) *adj.* Of, pertaining to, or near the rectum.

rec-tan-gle (rĕk'tăng'gəl) *n.* A parallelogram with a right angle. [Med. Lat. *rectangulum* : Lat. *rectus*, right + Lat. *angulus*, angle.]

rec-tan-gu-lar (rĕk-tăng'gyə-lər) *adj.* 1. Having the shape of a rectangle. 2. Having right angles. 3. Designating a geometric coordinate system with mutually perpendicular axes. —**rec-tan'gu-lar'i-ty** (-lăr'ĭ-tē) *n.* —**rec-tan'gu-lar-ly** *adv.*

rectangular coordinate *n. Math.* A coordinate in a rectangular Cartesian coordinate system.

rec-ti (rĕk'tī) *n.* Plural of **rectus.**

rec-ti-fi-er (rĕk'tə-fī'ər) *n.* 1. One that rectifies. 2. *Elect.* A device, as a diode, that converts alternating current to direct current. 3. A worker who blends or dilutes whiskey or other alcoholic beverages.

rec-ti-fy (rĕk'tə-fī') *tr.v.* **-fied, -fy·ing, -fies.** 1. To set right; correct. 2. To correct by calculation or adjustment. 3. *Chem.* To refine or purify, esp. by distillation. 4. *Elect.* To convert (alternating current) into direct current. 5. To adjust (the proof of alcoholic beverages) by adding water or other liquids. [ME *rectifien* < OFr. *rectifier* < Med. Lat. *rectificare* : *rectus*, right + *facere*, to make.] —**rec'ti-fi'a-ble** *adj.* —**rec'ti-fi-ca'tion** (-fə-kā'shən) *n.*

rec-ti-lin-e-ar (rĕk'tə-lĭn'ē-ər) *adj.* Moving in, consisting of, bounded by, or characterized by a straight line or lines. [LLat. *rectilineus* : Lat. *rectus*, right + Lat. *linea*, line.] —**rec'ti-lin'e-ar-ly** *adv.*

rec-ti-tude (rĕk'tĭ-tōōd', -tyōōd') *n.* 1. Moral uprightness; righteousness. 2. The quality or condition of being correct in intellectual judgment. 3. Straightness. [ME < OFr. < LLat. *rectitudo* < Lat. *rectus*, straight.]

rec-to (rĕk'tō) *n., pl.* **-tos.** The right-hand page of a book or the front side of a leaf, as opposed to the verso. [Lat. *recto (folio)*, (the page) being right.]

rec-tor (rĕk'tər) *n.* 1. A clergyman in charge of a parish in the Protestant Episcopal Church. 2. An Anglican clergyman who has charge of a parish and owns the tithes from it. 3. A Roman Catholic priest appointed to be managerial as well as spiritual head of a church or other institution such as a seminary or university. 4. The principal of certain schools, colleges, and universities. [Lat., director < *regere*, to rule.] —**rec'tor-ate** (-ĭt) *n.* —**rec-to'ri-al** (rĕk-tôr'ē-əl, -tōr'-) *adj.*

rec-to-ry (rĕk'tə-rē) *n., pl.* **1.** The house in which a parish priest or minister lives. **2. a.** An Anglican rector's dwelling. **b.** An Anglican rector's office and benefice.

rec-trix (rĕk'trĭks) *n., pl.* **rec-tri-ces** (rĕk'trĭ-sēz', rĕk-trī'sēz). One of the stiff main feathers of a bird's tail. [NLat. < Lat., fem. of *rector*, director < *regere*, to rule.]

rec-tum (rĕk'təm) *n., pl.* **-tums** or **-ta** (-tə). The portion of the large intestine extending from the sigmoid flexure to the anal canal. [NLat. *rectum (intestinum)*, straight (intestine).]

rec-tus (rĕk'təs) *n., pl.* **-ti** (-tī'). Any of various straight muscles, as of the abdomen, eye, neck, and thigh. [NLat. < Lat., straight.]

re-cum-bent (rĭ-kŭm'bənt) *adj.* 1. Lying down; reclining; *a recumbent statue of Aphrodite.* 2. Resting; idle. 3. *Biol.* Resting upon the surface from which it arises: *a recumbent organ.* [Lat. *recumbens*, pr.part. of *recumbere*, to lie down : *re-*, back + *cumbere*, to lie.] —**re-cum'bence, re-cum'ben-cy** *n.* —**re-cum'bent-ly** *adv.*

re-cu-per-ate (rĭ-kōō'pə-rāt', -kyōō'-) *v.* **-at·ed, -at·ing, -ates.**

THE HARPERCOLLINS DICTIONARY OF MATHEMATICS

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In memory of our grandparents.

ת" נ" צ" ב" ה"

$$1 - \tfrac{1}{2} + \tfrac{1}{3} - \tfrac{1}{4} + \tfrac{1}{5} - \tfrac{1}{6} + \ldots = \ln 2,$$

and

$$1 + \tfrac{1}{3} - \tfrac{1}{2} + \tfrac{1}{5} + \tfrac{1}{7} - \tfrac{1}{4} + \ldots = \ln\left(2\sqrt{2}\right),$$

while

$$1 - \tfrac{1}{2} + \tfrac{1}{3} + \tfrac{1}{5} - \tfrac{1}{4} + \tfrac{1}{7} + \tfrac{1}{9} + \tfrac{1}{11} - \tfrac{1}{8} + \ldots$$

is divergent. *Steinitz' theorem* shows that the set of limits of the convergent rearrangements of a series in Euclidean space always forms an AFFINE MANIFOLD, which is a singleton if and only if the series converges absolutely.

reciprocal, *adj.* **1a.** of or relating to a multiplicative inverse; for example, x^n and x^{-n} are reciprocal functions.

b. forming a multiplicative inverse. For example, the *reciprocal function*, $y = 1/x$ takes as its value for any argument the element whose product with the given argument is unity.

2. of or relating to the result of dividing 1 by a given number or quantity: for example, the reciprocal fraction of a/b is b/a.

3. (*as substantive*) **a.** an expression of the form $1/x$.

b. any function, expression, number or quantity that is reciprocal to another; for example, the reciprocal of a/b is b/a.

reciprocal polar curve, *n.* a pair of curves such that the POLAR of each point of one is tangential to the other. See POLE AND POLAR.

reciprocal polar figure, *n.* the figure related to a given configuration of points and lines in the plane in such a way that each point of either figure is the POLE of a line in the other (or equivalently, each line of either figure is the POLAR of a point in the other) with respect to some given conic, for example a pair of RECIPROCAL POLAR CURVES.

reciprocal variation, *n.* another term for INVERSE PROPORTION.

reciprocation, *n.* (*Geometry*) the transformation of a configuration of points and lines into its RECIPROCAL POLAR FIGURE.

reciprocity law, *n.* the law of QUADRATIC RECIPROCITY.

rectangle or **oblong,** *n.* a parallelogram with four right angles. An equilateral rectangle is a SQUARE.

rectangular, *adj.* **1.** shaped like a rectangle; having right angles.

2. mutually perpendicular.

rectangular coordinates, see CARTESIAN COORDINATES.

rectangular hyperbola, *n.* a HYPERBOLA of which the asymptotes are perpendicular; if $xy = c^2$, then the asymptotes are the coordinate axes, as in Fig. 311 opposite.

rectangular number, *n.* any number that is not PRIME, and so is expressible as $a \times b$, for a and b greater than 1; hence, equal to the number of unit-spaced points in a RECTANGULAR array, since the total number of points in such an array equals the product of the numbers of points in the sides. If these factors are equal, the number is a *square number*. See also FIGURATE NUMBER.

rectifiable, *adj.* (of a curve) possessing a well-defined ARC LENGTH; that is, if $a_1, \ldots, a_n$ are a set of points in order along the curve, the sum of the lengths of the chords from each a_i to a_{i+1} tends to a limit as n tends to infinity.

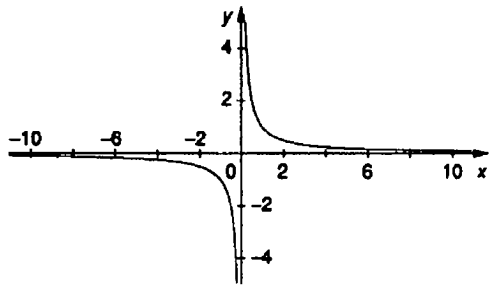

Fig. 311. **Rectangular hyperbola.**

rectify, *vb.* to determine the LENGTH of a curve.

rectilinear, *adj.* consisting of, bounded by, or formed of straight lines.

recur, *vb.* (of a digit or sequence of digits) to be repeated an infinite number of times at the end of the decimal expression of a fraction. For example, 3 recurs in the expansion of 241/500 as 0.83333...; this is read as 'point eight three–recurring' or 'point eight three–repeating', and is written $0.8\dot{3}$. See RECURRING DECIMAL. Compare TERMINATE.

recurrence relation or difference equation, *n.* an equation of the form

$$x_{n+p} = f(n, x_n, \ldots, x_{n+p-1})$$

that gives a RECURSIVE DEFINITION for the entire sequence, given p initial values; p is the *order* of the recurrence relation. Often there is no explicit dependence of f on n. For example, the n^{th} FIBONACCI NUMBER satisfies the recurrence relation

$$a_0 = 0, \quad a_1 = 1, \quad a_n = a_{n-1} + a_{n-2}.$$

recurring decimal, repeating decimal or **circulating decimal,** *n.* a RATIONAL NUMBER whose representation as a DECIMAL (or RADICAL) FRACTION contains a pattern of digits that repeats indefinitely after the decimal point. If the sequence of digits $a_1 a_2 \ldots a_n$ repeats, then the rational number represented by the recurring decimal is usually written

$$0.b_1 b \ldots b_m \dot{a}_1 \dot{a} \ldots \dot{a}_n$$

(where $b_1 \ldots b_m$ are digits that do not recur);

$$0.\dot{a}_1 \dot{a}_2 \ldots \dot{a}_n = \frac{a_1 a_2 \ldots a_n}{10^n - 1}$$

so that, for example,

$$0.\dot{1}4285\dot{7} = \frac{142857}{999999} = \frac{1}{7};$$

and

$$0.1\dot{3} = 10^{-1}\left(1 + \frac{3}{9}\right) = \frac{4}{30}.$$

Compare TERMINATE.